

### REMARKS

Claims 1, 3-8 and 10-16 were examined and reported in the Office Action. Claims 1, 3-8 and 10-16 are rejected. Claim 1 is amended. Claims 2 and 9 are canceled. New claim 17 is added. Claims 1, 3-8 and 10-17 remain.

Applicants request reconsideration of the application in view of the following remarks.

**I. 35 U.S.C. § 103(a)**

A. It is asserted in the Office Action that claims 1, 3, 10 and 14-16 are rejected under 35 U.S.C. §103(a) as being unpatentable over Haukka et al. ("Haukka") U. S. Patent Application 2003/0049942) in view of U. S. Patent No. 6,355,519 issued to Lee ("Lee"). Applicant respectfully traverses the foregoing rejections for the following reasons.

According to MPEP §2142 "[t]o establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." (*In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991)). Further, according to MPEP §2143.03, "[t]o establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. (*In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974))." "*All words in a claim must be considered in judging the patentability of that claim against the prior art.*" (*In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970), emphasis added.)

Applicant's amended claim 1 contains the following limitations "[a] method for forming a capacitor in a semiconductor device, comprising: forming a lower electrode constituted with a silicon layer on a semiconductor substrate by a predetermined

process on which a predetermined process has been completed; forming a uniform silicon oxide layer on the lower electrode by performing an atomic layer deposition (ALD) process; forming an aluminum oxide ( $\text{Al}_2\text{O}_3$ ) film on the silicon oxide layer by using an ALD method, wherein the method for forming the uniform silicon oxide layer and the aluminum oxide film reduces incubation time required for the formation of the  $\text{Al}_2\text{O}_3$  film on the silicon oxide layer and prevents metallic clusters from forming at an interface between the  $\text{Al}_2\text{O}_3$  film and the silicon oxide layer; crystallizing the  $\text{Al}_2\text{O}_3$  film by carrying out a heat treatment process, and forming an upper electrode on the  $\text{Al}_2\text{O}_3$  film, wherein the upper electrode includes multi-layers of a polysilicon layer and a metal layer."

Haukka discloses a method for forming dielectric layers on a substrate that includes the steps of forming an interfacial layer (preferably an oxide layer) and forming a high k-material is preferably deposited on the interfacial layer by a process not to cause substantial further growth of the interfacial layer. Whereas the silicon oxide layer and the  $\text{Al}_2\text{O}_3$  film of Applicant's claimed invention are formed by using an ALD method to reduce incubation time required for the formation of the  $\text{Al}_2\text{O}_3$  film on the lower layer and to prevent metallic clusters from forming at an interface between the  $\text{Al}_2\text{O}_3$  film and the silicon oxide layer. (See Applicant's specification, page 12, lines 4-6 and 9-12 ). Additionally, nowhere in Haukka is it disclosed, taught or suggested for forming an upper electrode on an  $\text{Al}_2\text{O}_3$  film provided with multi-layers comprising a polysilicon and a metal layer.

Lee discloses a method for fabricating a capacitor of a semiconductor device including the steps of: forming a surface nitride layer by performing a surface nitrification process for preventing formation of an oxide layer on the surface of the storage nodes that deteriorates dielectric characteristics of the layer; and forming an  $\text{Al}_2\text{O}_3$  layer on the surface nitride layer by using a conventional CVD method in a perovskite structure with superior electrical and mechanical strength. Whereas, the Applicant's claimed invention forms the  $\text{Al}_2\text{O}_3$  layer on the silicon oxide layer by using an ALD method to reduce incubation time required for the formation of the lower substrate layer and to prevent metallic clusters from forming at an interface between the  $\text{Al}_2\text{O}_3$  film and the silicon oxide layer. Even though a plate electrode made of silicon,

conductivity oxide or metal layer is disclosed in Lee, Lee does not teach, disclose or suggest forming an upper electrode on the  $\text{Al}_2\text{O}_3$  film provided with multi-layers comprising a polysilicon layer and a metal layer.

Applicant respectfully asserts that the combination of Haukka and Lee do not disclose, teach or suggest "forming an aluminum oxide ( $\text{Al}_2\text{O}_3$ ) film on the silicon oxide layer by using an ALD method, wherein the method for forming the uniform silicon oxide layer and the aluminum oxide film reduces incubation time required for the formation of the  $\text{Al}_2\text{O}_3$  film on the silicon oxide layer and prevents metallic clusters from forming at an interface between the  $\text{Al}_2\text{O}_3$  film and the silicon oxide layer; crystallizing the  $\text{Al}_2\text{O}_3$  film by carrying out a heat treatment process, and forming an upper electrode on the  $\text{Al}_2\text{O}_3$  film, wherein the upper electrode is multi-layers of a polysilicon layer and a metal layer." Moreover, the problems addressed by Haukka and Lee are different than Applicant's. Therefore an ordinary person skilled in the art would not be motivated to combine Haukka and Lee.

Since neither Haukka, Lee, nor the combination of the two disclose, teach or suggest all the limitations contained in Applicant's amended claim 1, as listed above, there would not be any motivation to arrive at Applicant's claimed invention. Thus, Applicant's amended claim 1 is not obvious over Haukka and Lee since a *prima facie* case of obviousness has not been met under MPEP §2142. Additionally, the claims that directly or indirectly depend from claim 1, namely claims 3, 10 and 14-16, would also not be obvious over Haukka and Lee for the same reason.

Accordingly, withdrawal of the 35 U.S.C. §103(a) rejections for claims 1, 3, 10 and 14-16 are respectfully requested.

**B.** It is asserted in the Office Action that claims 4-5 and 7-8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Haukka et al. and Lee in view of U. S. Patent No. 6,090,442 issued to Klaus et al. ("Klaus"). Applicant respectfully traverses the foregoing rejections for the following reasons.

Applicant's claims 4-5 and 7-8 directly or indirectly depend on amended claim 1. Applicant has addressed claim 1 in view of Haukka and Lee above in section I (A).

Klaus discloses a method for growing atomic layer thin films on substrates at room temperature using catalyzed binary reaction sequence chemistry. Applicant respectfully asserts that the combination of Haukka, Lee and Klaus do not disclose, teach or suggest "forming an aluminum oxide ( $\text{Al}_2\text{O}_3$ ) film on the silicon oxide layer by using an ALD method, wherein the method for forming the uniform silicon oxide layer and the aluminum oxide film reduces incubation time required for the formation of the  $\text{Al}_2\text{O}_3$  film on the silicon oxide layer and prevents metallic clusters from forming at an interface between the  $\text{Al}_2\text{O}_3$  film and the silicon oxide layer; crystallizing the  $\text{Al}_2\text{O}_3$  film by carrying out a heat treatment process, and forming an upper electrode on the  $\text{Al}_2\text{O}_3$  film, wherein the upper electrode is multi-layers of a polysilicon layer and a metal layer."

Since neither Haukka, Lee, Klaus, nor the combination of the three disclose, teach or suggest all the limitations contained in Applicant's amended claim 1, as listed above, there would not be any motivation to arrive at Applicant's claimed invention. Thus, Applicant's amended claim 1 is not obvious over Haukka and Lee, in further view of Klaus since a *prima facie* case of obviousness has not been met under MPEP §2142. Additionally, the claims that directly or indirectly depend from claim 1, namely claims 4-5 and 7-8, would also not be obvious over Haukka and Lee in view of Klaus for the same reason.

Accordingly, withdrawal of the 35 U.S.C. §103(a) rejections for claims 1-3, 9-10 and 14-16 are respectfully requested.

C. It is asserted in the Office Action that claims 4 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Haukka et al. and Lee in view of Tera et al. (U. S. Patent Application 2001/0031379). Applicant respectfully traverses the foregoing rejections for the following reasons.

Applicant's claims 4 and 6 directly or indirectly depend on amended claim 1. Applicant has addressed claim 1 in view of Haukka and Lee above in section I (A).

Tera discloses an organic electroluminescent (EL) device having a structure in which an anode, a hole transporting layer, an organic luminescent layer, and a cathode

are disposed on a glass substrate in this order. The organic EL device has a protective layer covering an outer surface of the structure to protect it from an external environment. The protective layer is formed by an atomic layer epitaxy (ALE) method at a temperature lower than glass transition temperatures materials constituting the hole transporting layer and the organic luminescent layer.

Applicant respectfully asserts that the combination of Haukka, Lee and Tera do not disclose, teach or suggest "forming an aluminum oxide ( $\text{Al}_2\text{O}_3$ ) film on the silicon oxide layer by using an ALD method, wherein the method for forming the uniform silicon oxide layer and the aluminum oxide film reduces incubation time required for the formation of the  $\text{Al}_2\text{O}_3$  film on the silicon oxide layer and prevents metallic clusters from forming at an interface between the  $\text{Al}_2\text{O}_3$  film and the silicon oxide layer; crystallizing the  $\text{Al}_2\text{O}_3$  film by carrying out a heat treatment process, and forming an upper electrode on the  $\text{Al}_2\text{O}_3$  film, wherein the upper electrode is multi-layers of a polysilicon layer and a metal layer."

Since neither Haukka, Lee, Tera, nor the combination of the three disclose, teach or suggest all the limitations contained in Applicant's amended claim 1, as listed above, there would not be any motivation to arrive at Applicant's claimed invention. Thus, Applicant's amended claim 1 is not obvious over Haukka and Lee, in further view of Tera since a *prima facie* case of obviousness has not been met under MPEP §2142. Additionally, the claims that directly or indirectly depend from claim 1, namely claims 4 and 6, would also not be obvious over Haukka and Lee in view of Tera for the same reason.

Accordingly, withdrawal of the 35 U.S.C. §103(a) rejections for claims 4 and 6 are respectfully requested.

**D.** It is asserted in the Office Action that claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Haukka et al. and Lee in view of Sarigiannis et al. (U. S. Patent Application 2004/0033688). Applicant respectfully traverses the foregoing rejections for the following reasons.

Applicant's claims 11 and 12 indirectly depend on amended claim 1.  
Applicant has addressed claim 1 in view of Haukka and Lee above in section III (A).

Sarigiannis discloses an atomic layer deposition method including positioning a semiconductor substrate within an atomic layer deposition chamber. On the substrate, an intermediate composition monolayer is formed, followed by a desired deposited composition from reaction with the intermediate composition, collectively from flowing multiple different composition deposition precursors to the substrate within the deposition chamber. A material adheres to a chamber internal component surface from such sequentially forming. After such sequentially forming, a reactive gas flows to the chamber which is different in composition from the multiple different deposition precursors and which is effective to react with such adhering material. After the reactive gas flowing, such sequentially forming is repeated.

Applicant respectfully asserts that the combination of Haukka, Lee and Sarigiannis do not disclose, teach or suggest "forming an aluminum oxide ( $\text{Al}_2\text{O}_3$ ) film on the silicon oxide layer by using an ALD method, wherein the method for forming the uniform silicon oxide layer and the aluminum oxide film reduces incubation time required for the formation of the  $\text{Al}_2\text{O}_3$  film on the silicon oxide layer and prevents metallic clusters from forming at an interface between the  $\text{Al}_2\text{O}_3$  film and the silicon oxide layer; crystallizing the  $\text{Al}_2\text{O}_3$  film by carrying out a heat treatment process, and forming an upper electrode on the  $\text{Al}_2\text{O}_3$  film, wherein the upper electrode is multi-layers of a polysilicon layer and a metal layer."

Since neither Haukka, Lee, Sarigiannis, nor the combination of the three disclose, teach or suggest all the limitations contained in Applicant's amended claim 1, as listed above, there would not be any motivation to arrive at Applicant's claimed invention. Thus, Applicant's amended claim 1 is not obvious over Haukka and Lee, in further view of Sarigiannis since a *prima facie* case of obviousness has not been met under MPEP §2142. Additionally, the claims that directly or indirectly depend from claim 1, namely claims 11 and 12, would also not be obvious over Haukka and Lee in view of Sarigiannis for the same reason.

Accordingly, withdrawal of the 35 U.S.C. §103(a) rejections for claims 11 and 12 are respectfully requested.

E. It is asserted in the Office Action that claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Haukka et al. and Lee in view of Raaijmakers et al. (U. S. Patent Application 2001/0024387). Applicant respectfully traverses the foregoing rejections for the following reasons.

Applicant's claim 13 directly depends on amended claim 1. Applicant has addressed claim 1 in view of Haukka and Lee above in section I (A).

Raaijmakers discloses a method for conforming capacitor dielectrics over textured silicon electrodes for integrated memory cells. Capacitor structures and first electrodes or plates are formed above or within semiconductor substrates. The first electrodes include hemispherical grain (HSG) silicon for increasing the capacitor plate surface area. The HSG topography is then exposed to alternating chemistries to form monolayers of a desired dielectric material.

Applicant respectfully asserts that the combination of Haukka, Lee and Raaijmakers do not disclose, teach or suggest "forming an aluminum oxide ( $\text{Al}_2\text{O}_3$ ) film on the silicon oxide layer by using an ALD method, wherein the method for forming the uniform silicon oxide layer and the aluminum oxide film reduces incubation time required for the formation of the  $\text{Al}_2\text{O}_3$  film on the silicon oxide layer and prevents metallic clusters from forming at an interface between the  $\text{Al}_2\text{O}_3$  film and the silicon oxide layer; crystallizing the  $\text{Al}_2\text{O}_3$  film by carrying out a heat treatment process, and forming an upper electrode on the  $\text{Al}_2\text{O}_3$  film, wherein the upper electrode is multi-layers of a polysilicon layer and a metal layer."

Since neither Haukka, Lee, Raaijmakers, nor the combination of the three disclose, teach or suggest all the limitations contained in Applicant's amended claim 1, as listed above, there would not be any motivation to arrive at Applicant's claimed invention. Thus, Applicant's amended claim 1 is not obvious over Haukka and Lee, in further view of Raaijmakers since a *prima facie* case of obviousness has not been met under MPEP §2142. Additionally, the claim that directly depends from claim 1, namely

claim 13, would also not be obvious over Haukka and Lee in view of Raaijmakers for the same reason.

Accordingly, withdrawal of the 35 U.S.C. §103(a) rejection for claim 13 is respectfully requested.



**CONCLUSION**

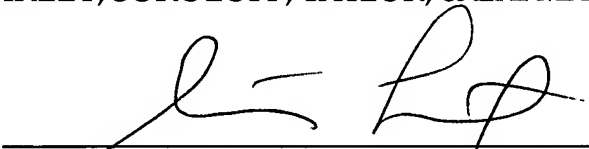
In view of the foregoing, it is believed that all claims now pending, namely 1, 3-8 and 10-17, patentably define the subject invention over the prior art of record and are in condition for allowance and such action is earnestly solicited at the earliest possible date.

If necessary, the Commissioner is hereby authorized in this, concurrent and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2666 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17, particularly extension of time fees. If a telephone interview would expedite the prosecution of this Application, the Examiner is invited to contact the undersigned at (310) 207-3800.

Respectfully submitted,

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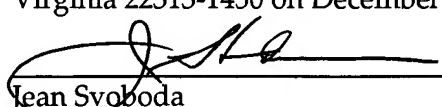
Dated: December 14, 2004

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Jean Svoboda